

REFERENCES FOR THE MRI PORTABLE WIND TUNNEL METHOD

Since the 1950's, the U.S. Department of Agriculture has used portable wind tunnels to measure total soil loss from wind erosion. Soil loss is dominated by creep (rolling) and saltation (bouncing). The USDA was not interested in fractional soil loss due to particle resuspension, because particle resuspension constitutes only about 1 percent of the total soil loss.

Development of the MRI Portable Wind Tunnel

In 1978 as the interest in air pollution grew, the MRI portable wind tunnel was constructed to provide a critical feature not present in the earlier portable wind tunnels: the ability to measure fine particle emissions. The MRI portable wind tunnel used a design that was scaled directly from a smaller version built by Dr. Dale Gillette, and a downstream particle sampling module was added to the wind tunnel design.

Dr. Gillette used his wind tunnel to study threshold velocities for wind erosion of arid soils. His justification for the appropriateness of the portable wind tunnel method was detailed in the following publication.

Gillette, Dale (1978). "Tests with a Portable Wind Tunnel for Determining Wind Erosion Threshold Velocities." *Atmos. Environ.* 12:2309.

Documentation of Field Studies

Since its development in 1978, the MRI portable wind tunnel method has been used in field studies that characterized fine particle emissions from a variety of erodible surface materials. Some of these studies are described in the following publications:

Farber, R. J., B. M. Kim, C. Cowherd, Jr., et al., "New Approaches to Dust Mitigation in the Antelope Valley," Presented at the 92nd Annual Meeting of the Air and Waste Management Association, St. Louis, Missouri, June 1999.

Cowherd, C., Jr., "Wind Erosion Emissions of Fine Particles from Limited Reservoir Surfaces," Presented at the 50th International Symposium on Wind Erosion, Manhattan, Kansas, June 1997.

Cowherd, C., Jr., and M. A. Grelinger, "Advances in Estimating Fine Particle Wind Erosion Emissions from Land Contamination Sites," Paper 95-TP55.07. Presented at the 88th Annual Meeting of the Air and Waste Management Association, San Antonio, Texas, June 1995.

Cowherd, C., Jr., "Fugitive Dust Emissions," in *Aerosol Measurement: Principles, Techniques, and Applications*, K. Willeke and P. A. Baron, Eds., Van Nostrand Reinhold, New York, New York, 1993.

Cowherd, C., Jr., "Emission Factors for Wind Erosion of Exposed Aggregates at Surface Coal Mines." Paper 82-15.5. Presented at the 75th Annual Meeting of the Air Pollution Control Association, New Orleans, Louisiana, June 1982.

Cowherd, C., Jr., C. R. Hodgkin, and D. D. Lane, "*In Situ* Measurement of Wind-Generated Particulate Emissions from Exposed Aggregates," Presented at the EPA 3rd Symposium on the Transfer and Utilization of Particulate Control Technology, Orlando, Florida, March 1981.

Cowherd, C., Jr., "Control of Windblown Dust from Storage Piles," *Environment International*, 6, 307-311, 1981.

Cowherd, C., Jr., T. Cuscino, Jr., and D. A. Gillette, "Development of Emission Factors for Wind Erosion of Aggregate Storage Piles," Paper 79-1.1. Presented at the 72nd Annual Meeting of the Air Pollution Control Association, Cincinnati, Ohio, June 1979.

Although more refined particle monitors have been incorporated into the MRI wind tunnel over the years, the basic method has remained intact.

Endorsement by USEPA

The MRI portable wind tunnel method has been endorsed by the U.S. Environmental Protection Agency as the preferred method for developing wind erosion emission factors for surfaces with "limited reservoir" erosion characteristics, such as those found in Rocky Flats soils. This is illustrated by the following publications:

U.S. Environmental Protection Agency. *National Technical Guidance Series Air Pathway Analysis Procedure for Superfund Applications*. Vol. II: *Estimates of Air Emissions at Superfund Sites*. EPA-450/1-89-002a, 1989.

Cowherd, Chatten, Jr.. *Background Document for AP-42 Section 11.2.7 on Industrial Wind Erosion*. EPA Contract No. 68-02-4395. Midwest Research Institute, July 1988.

Cowherd, C. Jr., G. E. Muleski, P. J. Englehart, and D. A. Gillette. *Rapid Assessment of Exposure to Particulate Emissions from Surface Contamination Sites*. EPA Publication EPA/600/8-85/002. Washington, DC., U.S. EPA. 1985.

Axetell, K., Jr., and C. Cowherd, Jr., "Improved Emission Factors for Fugitive Dust from Western Surface Coal Mining Sources," EPA Publication EPA-600/7-84-048; NTIS Publication PB84-170802, March 1984.

Other Portable Wind Tunnels

In 1990, MRI was contracted to build two reduced-scale portable wind tunnels for application to Owens Dry Lake, which is the largest single wind erosion source in the U.S. (110 sq. mi.). The reduced-scale wind tunnels used to map the erodibility of the dry lakebed are described in the following publications:

Cowherd, Chatten, Jr. *Wind Tunnel Comparability Study—Test Report*. Prepared by Midwest Research Institute for Great Basin Unified Air Pollution Control District, November 1993. .

Cowherd, C., Jr., and D. M. Ono, "Design and Testing of a Reduced-Scale Wind Tunnel for Surface Erodibility Determinations," Paper 90-84.6. Presented at the 83rd Annual Meeting of the Air and Waste Management Association, June 1990.

Other investigators have consulted with MRI in constructing portable wind tunnels for use in characterizing the fine particle emission potential of western soils. These include:

**Dr. David James
University of Nevada at Las Vegas
Las Vegas, Nevada**

**Dr. Keith Saxton
United States Department of Agriculture
Spokane, Washington**

Their portable wind tunnels are still being used in studies of the Columbia Plateau and areas around Las Vegas.

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